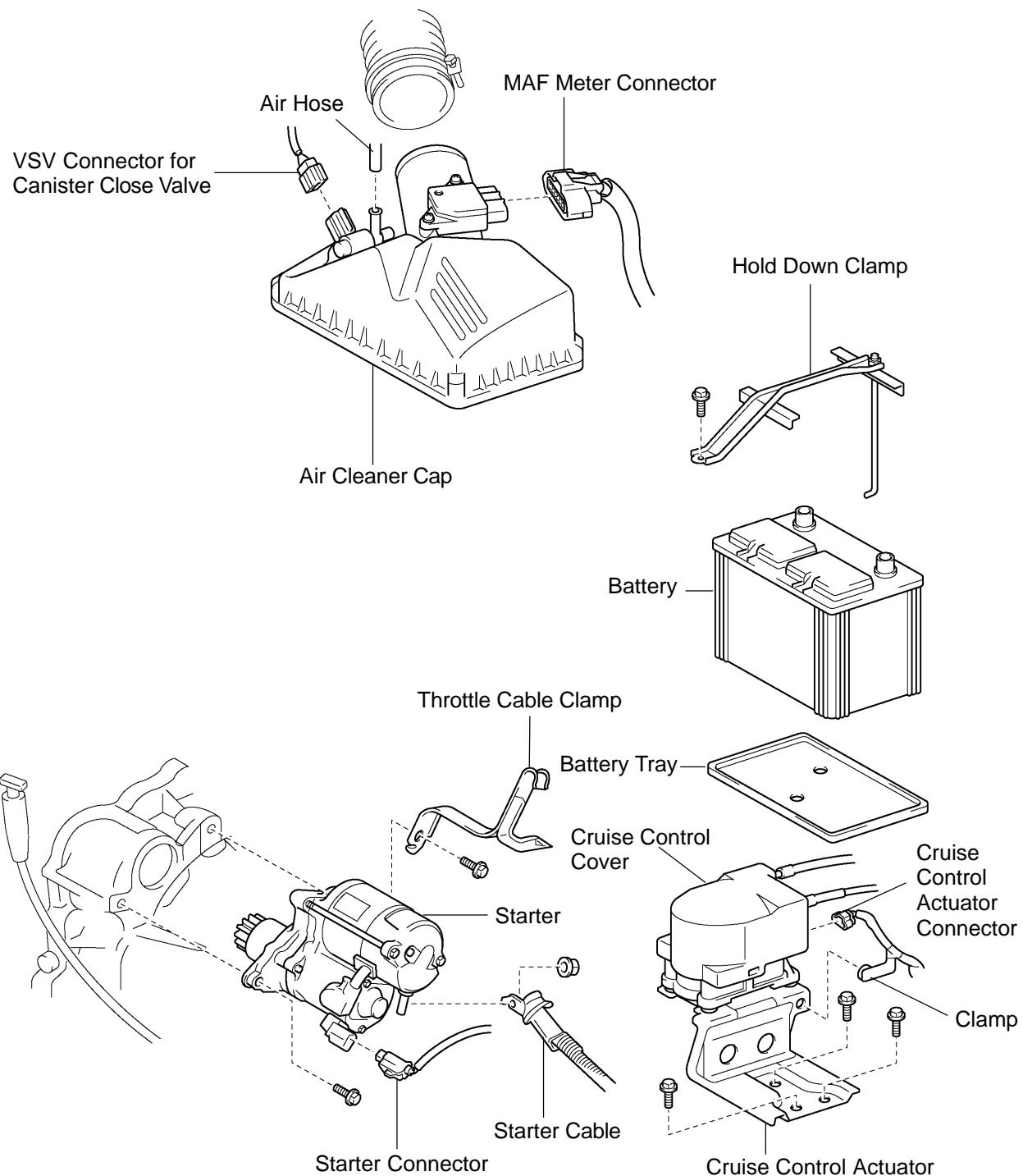
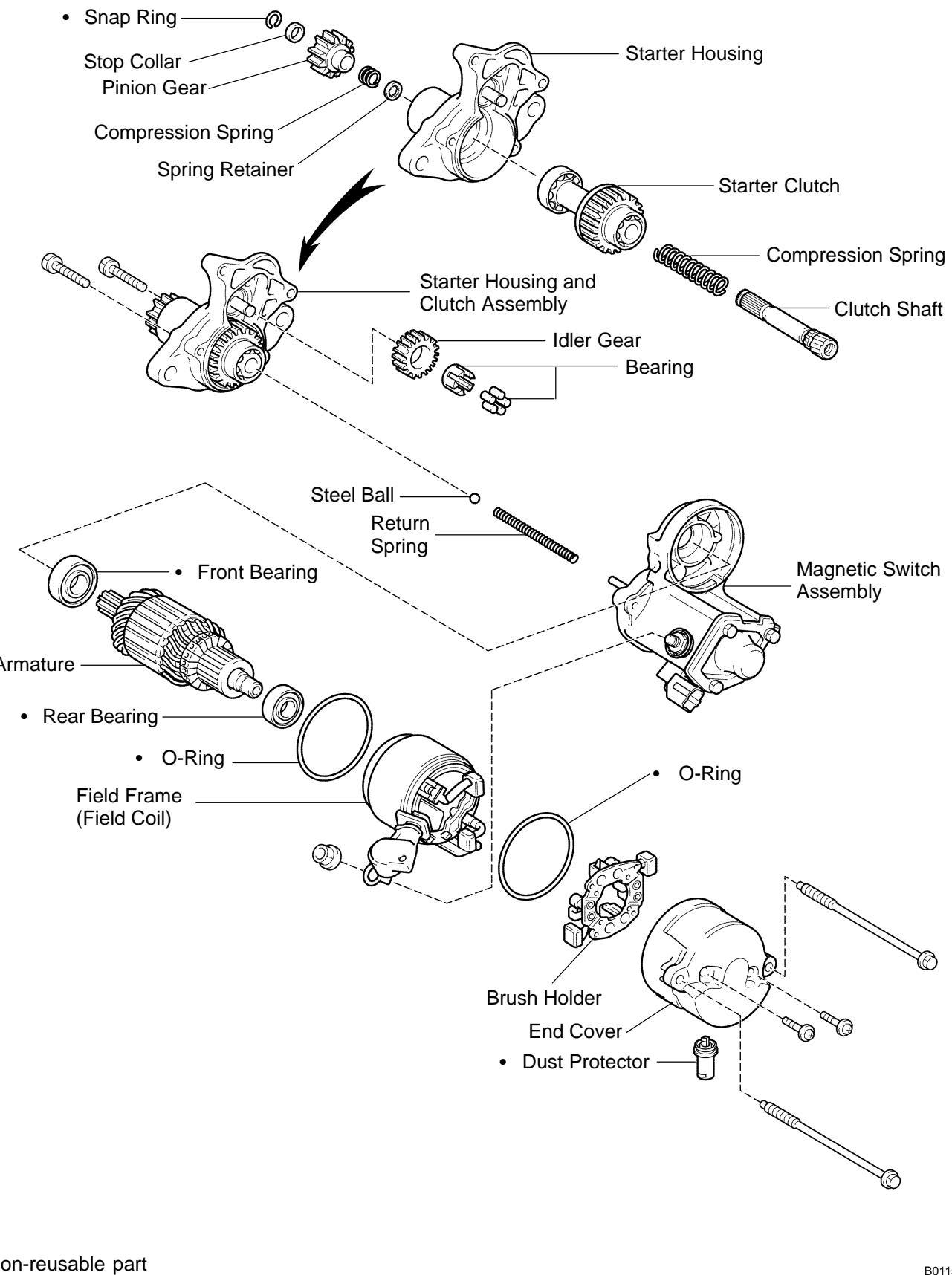


STARTER

COMPONENTS

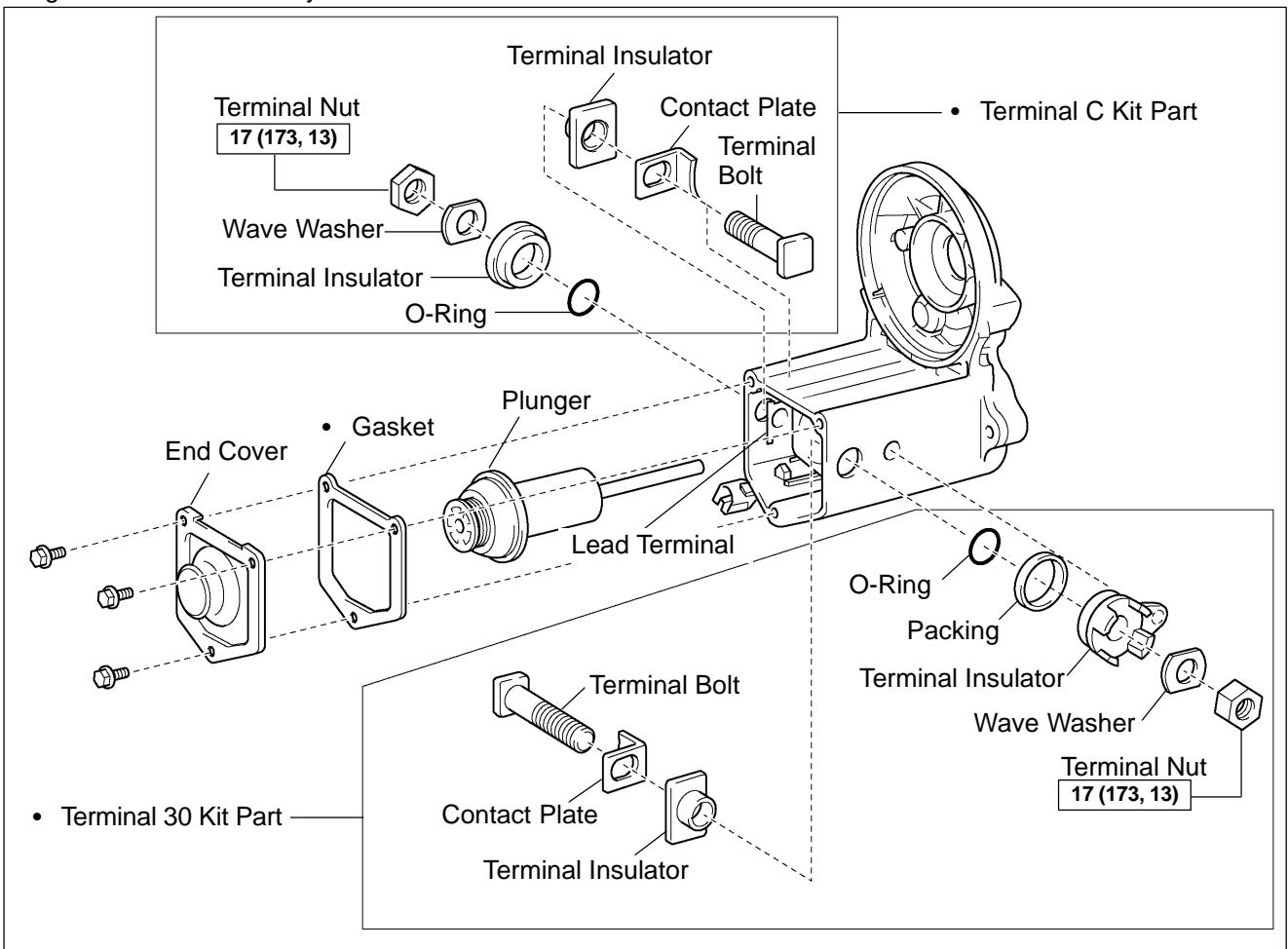
ST04N-03





B01154

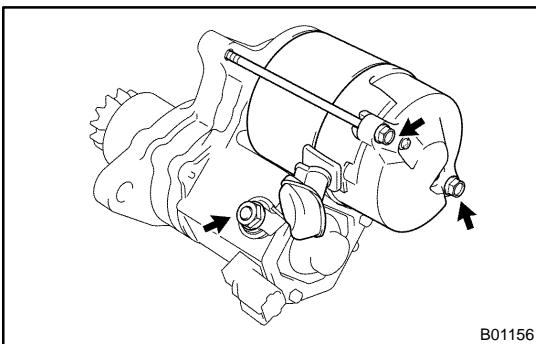
Magnetic Switch Assembly



N·m (kgf·cm, ft-lbf) : Specified torque

γ • Non-reusable part

B06429

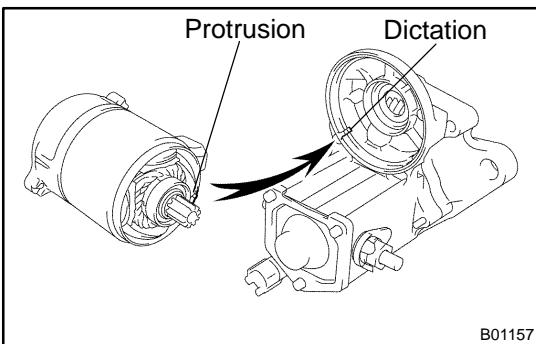


DISASSEMBLY

1. **REMOVE DUST PROTECTOR**
2. **REMOVE FIELD FRAME AND ARMATURE**

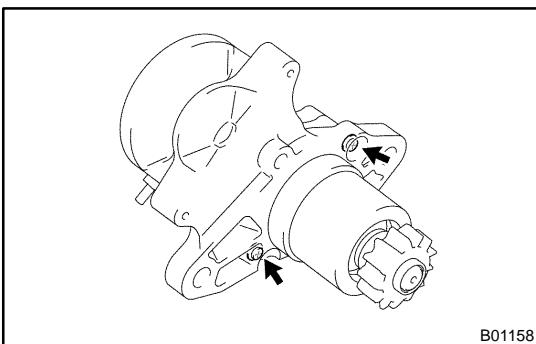
(a) Remove the nut, and disconnect the lead wire from the magnetic switch terminal.
Torque: 5.9 N·m (60 kgf·cm, 52 in.-lbf)

(b) Remove the 2 through bolts.
Torque: 5.9 N·m (60 kgf·cm, 52 in.-lbf)



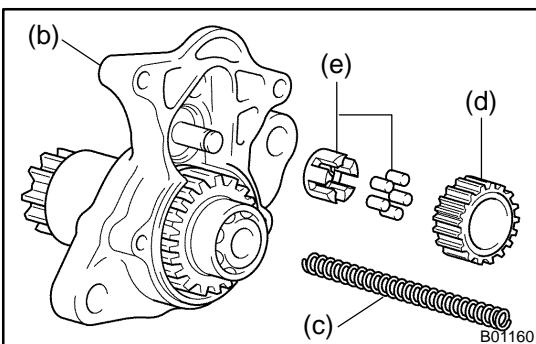
(c) Pull out the field frame together with the armature.
HINT:
 Align the protrusion of the field frame with the indentation of the magnetic switch.

(d) Remove the O-ring from the field frame.
HINT:
 At the time of installation, please refer to the following items.
 Use a new O-ring.

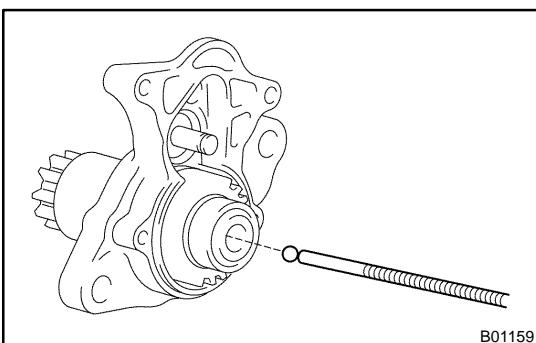


3. **REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR**

(a) Remove the 2 screws.
Torque: 5.9 N·m (60 kgf·cm, 52 in.-lbf)

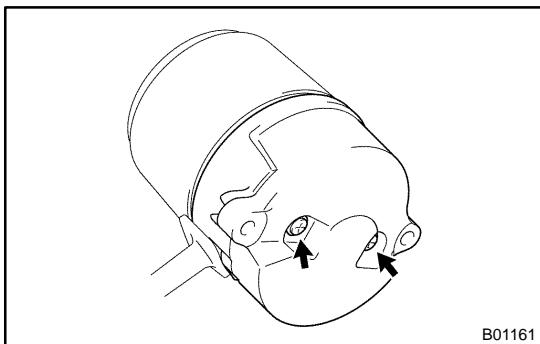


(b) Remove the starter housing and clutch assembly.
 (c) Remove the return spring.
 (d) Remove the idler gear.
 (e) Remove the bearing.



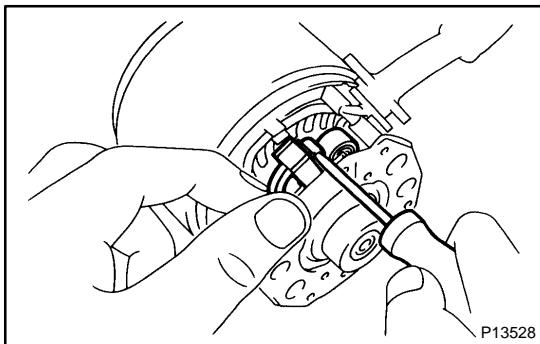
4. **REMOVE STEEL BALL**

Using a magnetic finger, remove the steel ball from the clutch shaft hole.



5. REMOVE BRUSH HOLDER

- (a) Remove the 2 screws and end cover from the field frame.
Torque: 1.5 N·m (15 kgf·cm, 13 in.-lbf)
- (b) Remove the O-ring from the field frame.



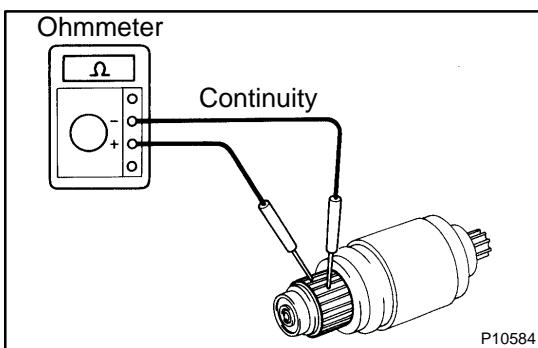
- (c) Using a screwdriver, hold the spring back and disconnect the brush from the brush holder.

Disconnect the 4 brushes, and remove the brush holder.

NOTICE:

Check that the positive (+) lead wires are not grounded.

6. REMOVE ARMATURE FROM FIELD FRAME



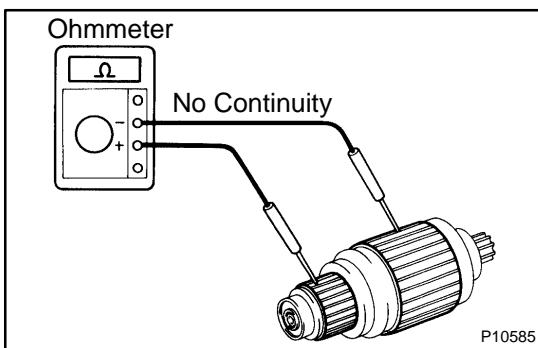
INSPECTION

1. INSPECT ARMATURE COIL

(a) Check the commutator for open circuit.

Using an ohmmeter, check that there is continuity between the segments of the commutator.

If there is no continuity between any segment, replace the armature.



(b) Check the commutator for ground

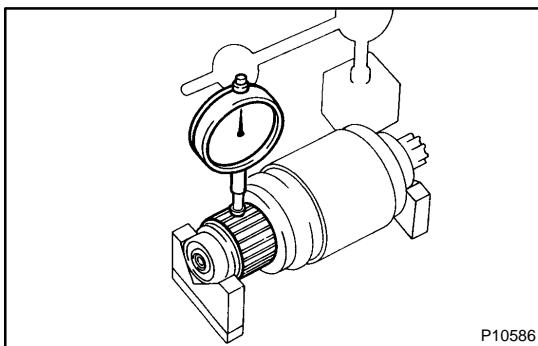
Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.

2. INSPECT COMMUTATOR

(a) Check the commutator for dirty and burnt surfaces.

If the surface is dirty or burnt, correct it with sandpaper (No.400) or on a lathe.



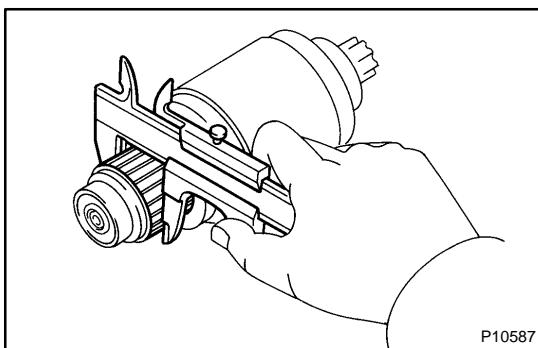
(b) Check the commutator circle runout.

(1) Place the commutator on V-blocks.

(2) Using a dial gauge, measure the circle runout.

Maximum circle runout: 0.05 mm (0.0020 in.)

If the circle runout is greater than maximum, correct it on a lathe.

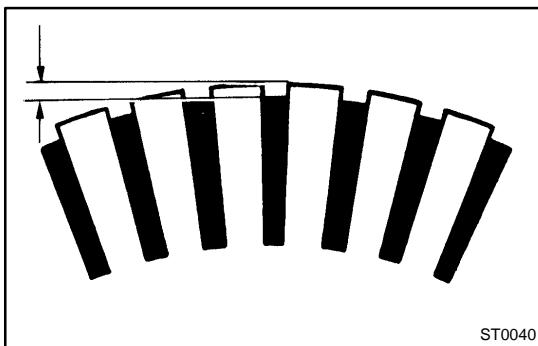


(c) Using vernier calipers, measure the commutator diameter.

Standard diameter: 30.0 mm (1.181 in.)

Minimum diameter: 29.0 mm (1.142 in.)

If the diameter is less than minimum, replace the armature.

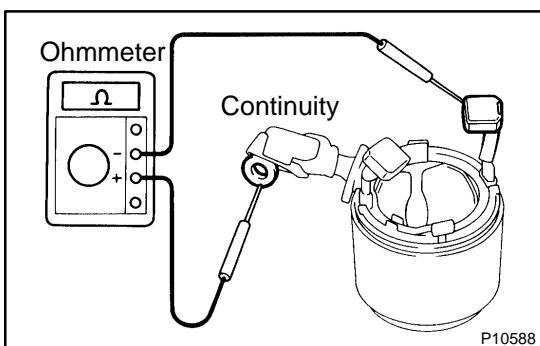


(d) Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

Standard undercut depth: 0.6 mm (0.024 in.)

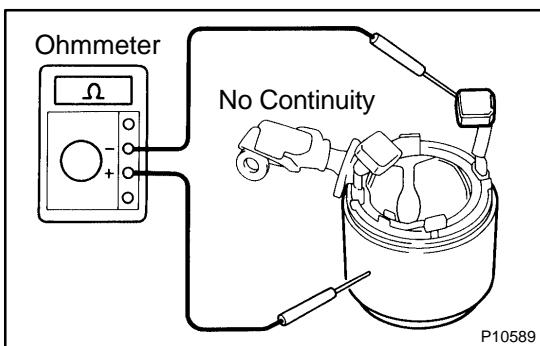
Minimum undercut depth: 0.2 mm (0.008 in.)

If the undercut depth is less than minimum, correct it with a hacksaw blade.

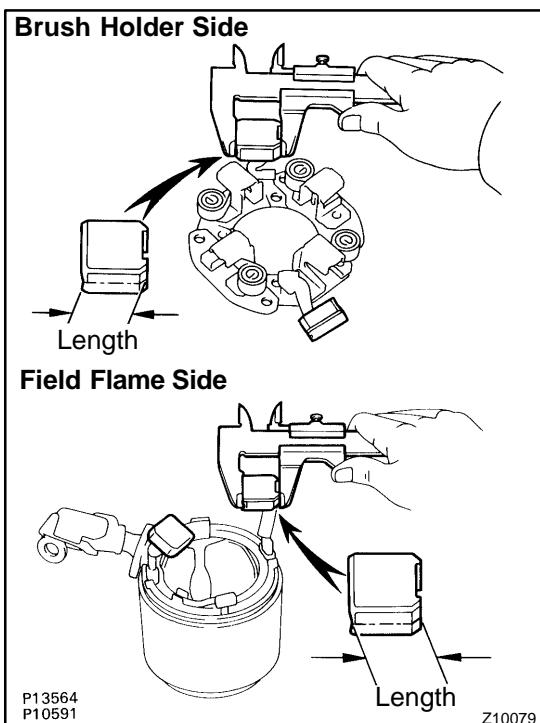


3. INSPECT FIELD COIL

(a) Check the field coil for open circuit.
Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.
If there is no continuity, replace the field frame.



(b) Check the field coil for ground.
Using an ohmmeter, check that there is no continuity between the field coil end and field frame.
If there is continuity, repair or replace the field frame.



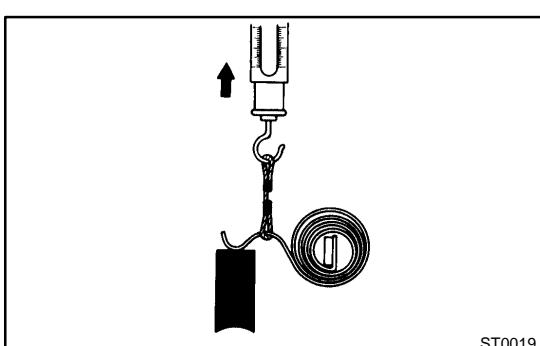
4. INSPECT BRUSHES

Using vernier calipers, measure the brush length.

Standard length: 15.5 mm (0.610 in.)

Minimum length: 10 mm (0.394 in.)

If the length is less than minimum, replace the brush holder and field frame.



5. INSPECT BRUSH SPRINGS

Check the brush spring road.

Take the pull scale reading the instant the brush spring separates from the brush.

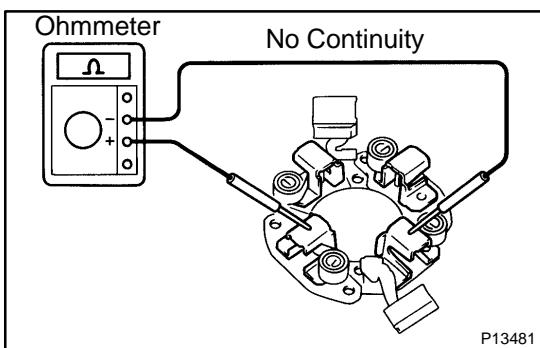
Standard spring installed load:

17.6 - 23.5 N (1.79 - 2.41 kgf, 4.0 - 5.3 lbf)

Minimum spring installed load:

11.8 N (1.20 kgf, 2.7 lbf)

If the installed load is less than minimum replace the brush springs.



6. INSPECT BRUSH HOLDER

Check the brush holder insulation.

Using an ohmmeter, check that there is no continuity between the positive (+) and negative (-) brush holders.

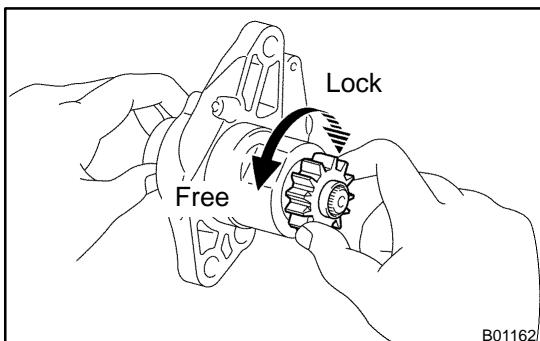
If there is continuity, repair or replace the brush holder.

7. INSPECT CLUTCH AND GEAR

(a) Check the gear teeth on the pinion gear, idler gear and clutch assembly for wear or damage.

If damaged, replace the gear or clutch assembly.

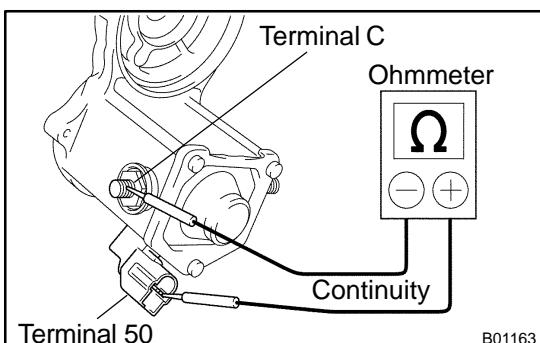
If damaged, also check the drive plate ring gear for wear or damage.



(b) Check the clutch pinion gear.

Hold the starter clutch and rotate the pinion gear counter-clockwise, and check that it turns freely. Try to rotate the pinion gear clockwise and check that it locks.

If necessary, replace the clutch assembly.

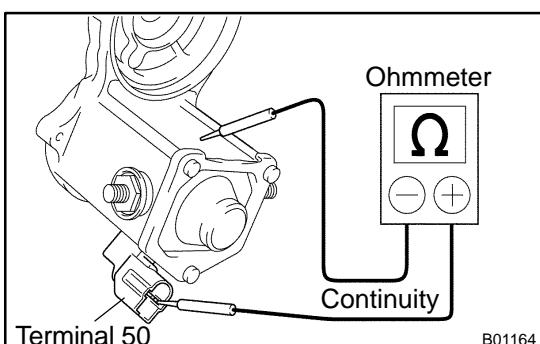


8. INSPECT MAGNETIC SWITCH

(a) Check the pull-in coil for open circuit.

Using an ohmmeter, check that there is continuity between terminals 50 and C.

If there is no continuity, check and replace the magnetic switch.



(b) Check the hold-in coil open circuit.

Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

If there is no continuity, replace the magnetic switch.

9. INSPECT BEARING

Turn the bearing by hand while applying inward force.

If resistance is felt or the bearing sticks, replace the bearing (See page ST-11).

INSTALLATION

Installation is in the reverse order of removal (See page [ST-5](#)).

REASSEMBLY

Reassembly is in the reverse order of disassembly (See page [ST-6](#)).

HINT:

Use high temperature grease to lubricate the bearings, springs, steel ball and gears when assembling the starter.

REMOVAL

1. REMOVE AIR CLEANER CAP
2. REMOVE BATTERY AND TRAY
3. REMOVE CRUISE CONTROL ACTUATOR
 - (a) Disconnect the actuator connector and clamp.
 - (b) Remove the 3 bolts, and disconnect the actuator with the bracket.
4. REMOVE STARTER
 - (a) Disconnect the starter connector.
 - (b) Remove the nut, and disconnect the starter cable.
 - (c) Remove the 2 bolts, throttle cable clamp and starter.

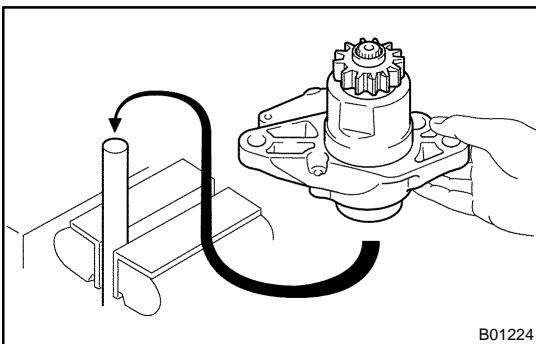
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

REPLACEMENT

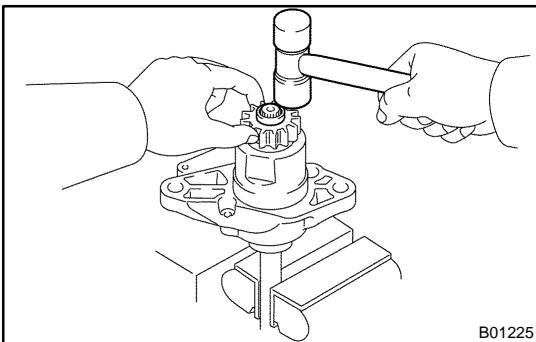
1. REPLACE CLUTCH ASSEMBLY

(a) Disassemble the starter housing and the clutch assembly.

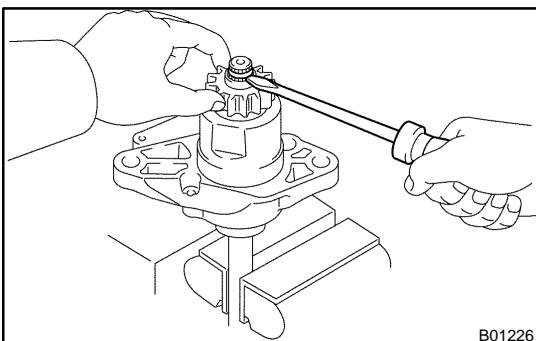
- (1) Mount a brass bar in a vice, and install the starter housing and clutch assembly to the brass bar.



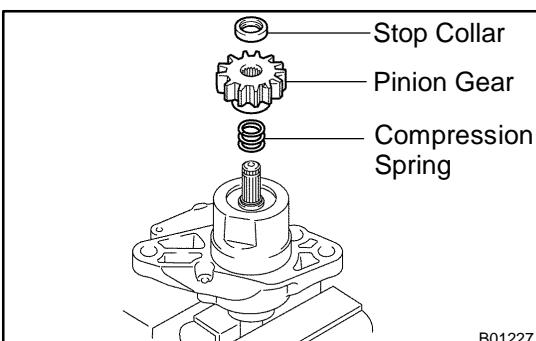
B01224



B01225

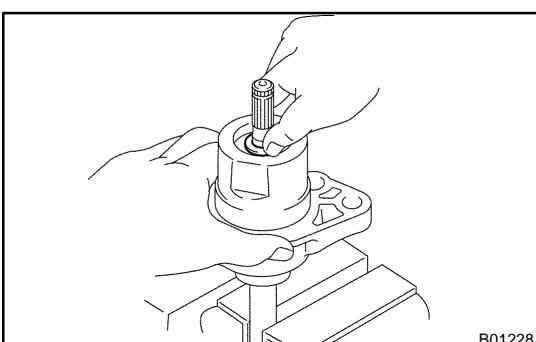


B01226



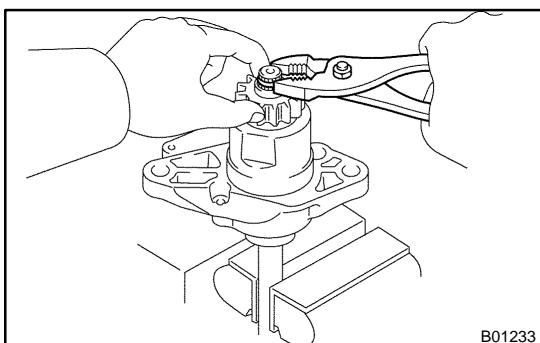
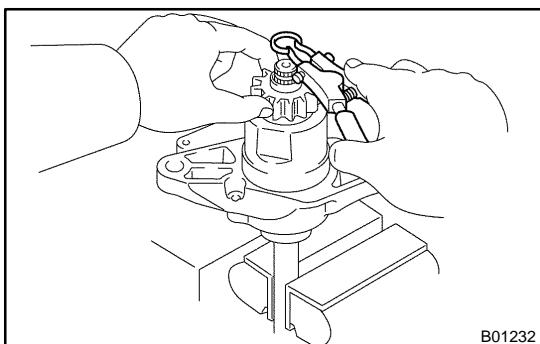
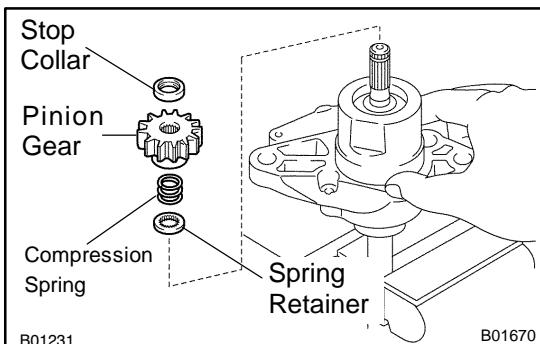
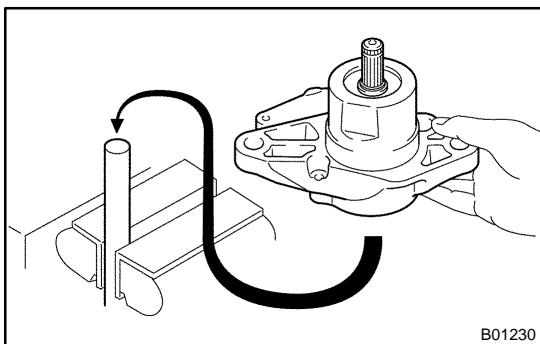
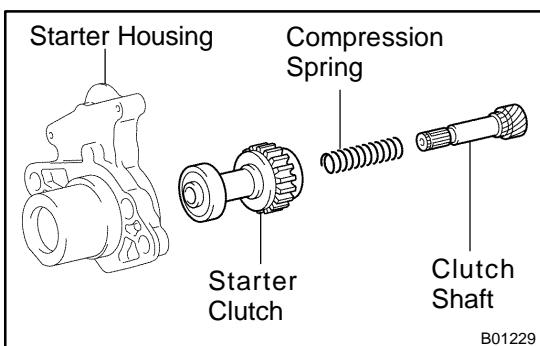
B01227

- (2) Push down the pinion gear.
- (3) Using a plastic-faced hammer, tap down the stop collar.
- (4) Using a screwdriver, pry out the snap ring.



B01228

- (5) Remove the stop collar, pinion gear and compression spring.
- (6) Push down the starter housing, and remove the spring retainer.
- (7) Remove the starter clutch from the starter housing.
- (8) Remove the clutch shaft and compression spring from the starter clutch.



(b) Assemble the starter housing and the clutch assembly.

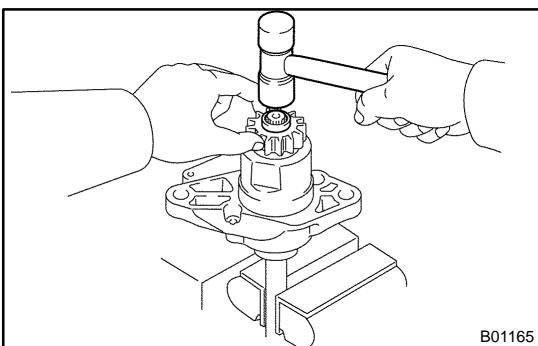
- (1) Install the compression spring and clutch shaft to the starter clutch.
- (2) Install the starter clutch to the starter housing.

(3) Mount a brass bar in a vice, install the starter housing and clutch assembly to the brass bar.

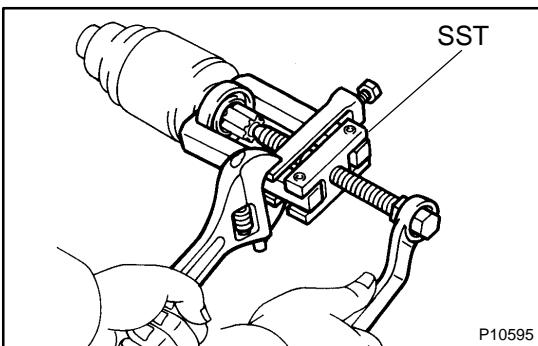
(4) Push down the starter housing, and install the spring retainer, compression spring, pinion gear and stop collar.

(5) Push down the pinion gear.
 (6) Using snap ring pliers, install a new snap ring.

(7) Using pliers, compress the snap ring.
 (8) Check that the snap ring fits correctly.

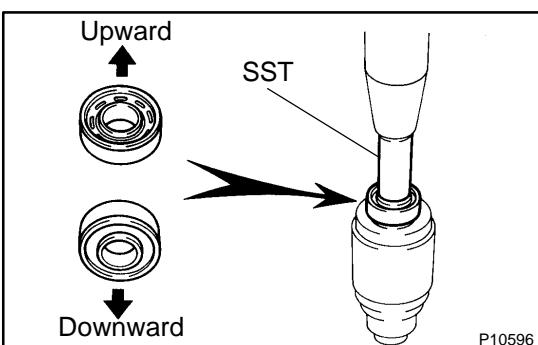


- (9) Remove the starter housing and clutch assembly from the brass bar.
- (10) Using a plastic-faced hammer, tap the clutch shaft and install the stop collar onto the snap ring.



2. REPLACE FRONT BEARING

- (a) Using SST, remove the bearing.
SST 09286-4601 1

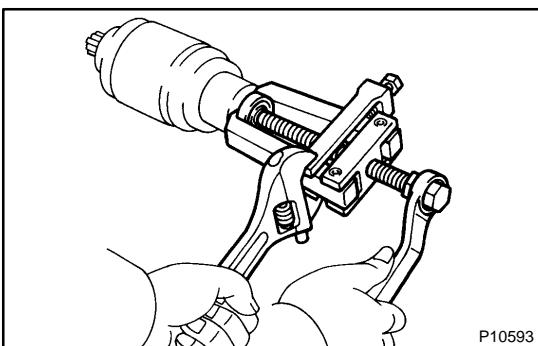


- (b) Using SST and a press, press in a new bearing.

NOTICE:

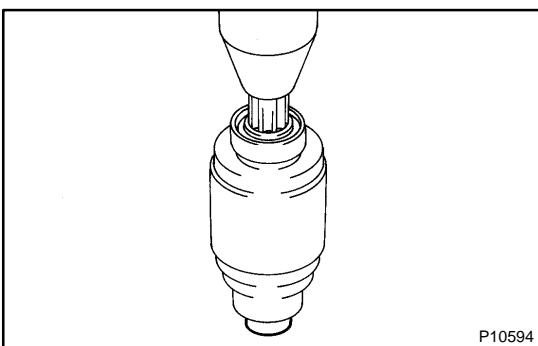
Be careful of the bearing installation direction.

SST 09820-00030

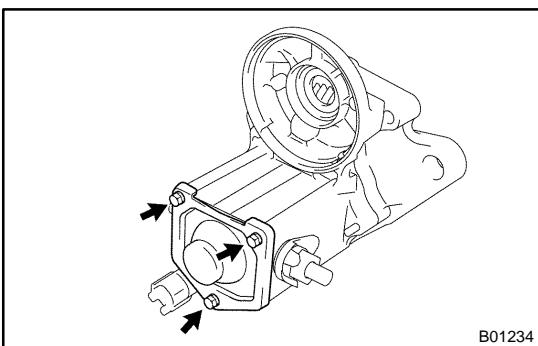


3. REPLACE REAR BEARING

- (a) Using SST, remove the bearing.
SST 09286-4601 1

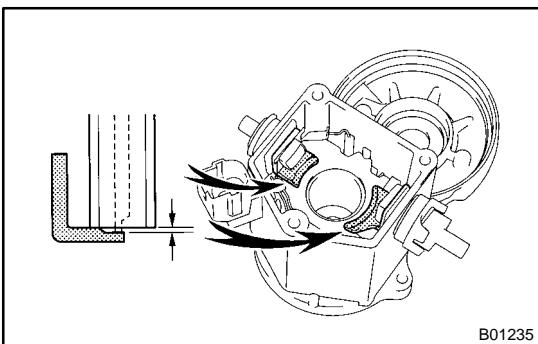


- (b) Using a press, press in a new bearing.



4. REPLACE MAGNETIC SWITCH TERMINAL KIT PARTS

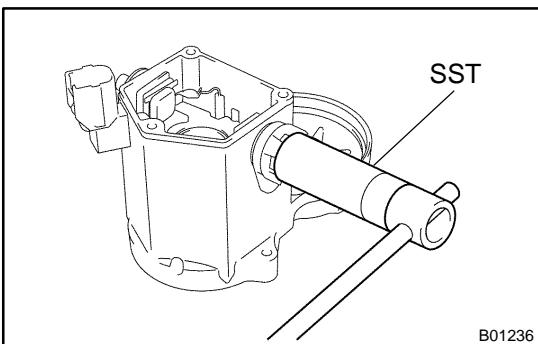
(a) Remove the 3 bolts, end cover, gasket and plunger.



(b) Using vernier calipers, measure the contact plate for depth of wear.

Maximum wear: 0.9 mm (0.035 in.)

If the depth of wear is greater than the maximum, replace the contact plate.



(c) Remove the terminal kit parts

(1) Using SST, loosen the terminal nuts.

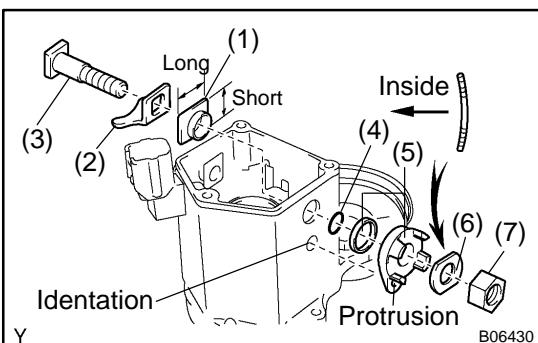
SST 09810-38140

(2) Terminal C:

Remove the terminal nut, wave washer, terminal insulator (outside), O-ring, terminal bolt, contact plate and terminal insulator (inside).

(3) Terminal 30:

Remove the terminal nut, wave washer, terminal insulator (outside), packing, O-ring, terminal bolt, contact plate, terminal insulator (inside).



(d) Install new terminal 30 kit parts.

(1) Temporarily install a new terminal insulator (inside).
 (2) Temporarily install a new contact plate.
 (3) Temporarily install a new terminal bolt.
 (4) Temporarily install a new O-ring.
 (5) Temporarily install a new packing and a new terminal insulator (outside).

Install a new packing to a new terminal insulator, and install them.

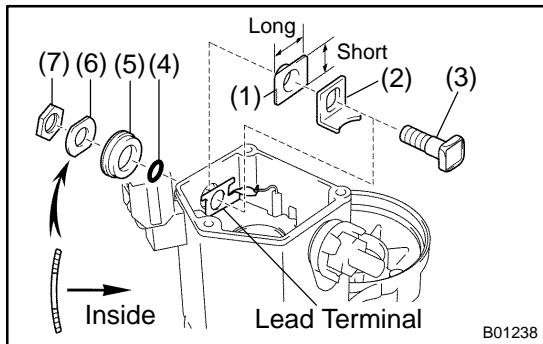
HINT:

Match the protrusion of the insulator with the indentation of the housing.

- (6) Temporarily install a new wave washer.
- (7) Temporarily install a new terminal nut.

NOTICE:

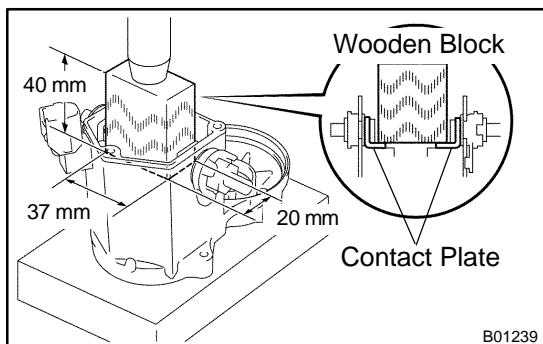
Be careful to install the terminal insulators (inside) and wave washers in the correct direction.



- (e) Temporarily install new terminal kit parts.
 - (1) Temporarily install a new terminal insulator (inside).
 - (2) Temporarily install a new contact plate.
 - (3) Temporarily install a new terminal bolt.
 - (4) Temporarily install a new O-ring.
 - (5) Temporarily install a new terminal insulator (outside).
 - (6) Temporarily install a new wave washer.
 - (7) Temporarily install a new terminal nut.

NOTICE:

Be careful to install the terminal insulators (inside) and wave washers in the correct direction.



- (f) Tighten terminal nuts.
 - (1) Put a wooden block on the contact plate and press it down with a hand press.

Dimensions of wooden block:

20 x 37 x 40 mm (0.79 x 1.46 x 1.57 in.)

Press force:

981 N (100 kgf, 221 lbf)

NOTICE:

- Check the diameter of the hand press ram. Then calculate the gauge pressure of the press when 981 N (100 kgf, 221 lbf) of force is applied.

Gauge pressure:

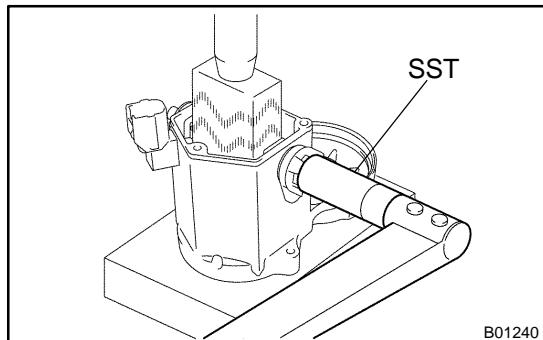
$$(\text{kgf/cm}^2) = \frac{100 \text{ kgf}}{\left(\frac{\text{Ram diameter (cm)}}{2} \right)^2 \times 3.14 (\pi)}$$

$$(\text{psi}) = \frac{221 \text{ lbf}}{\left(\frac{\text{Ram diameter (in.)}}{2} \right)^2 \times 3.14 (\pi)}$$

$$(\text{kPa}) = (\text{kgf/cm}^2) \times 98.1$$

$$(\text{kPa}) = (\text{psi}) \times 6.9$$

- If the contact plate is not pressed down with the specified pressure, the contact plate may tilt due to coil deformation or the tightening of the nut.



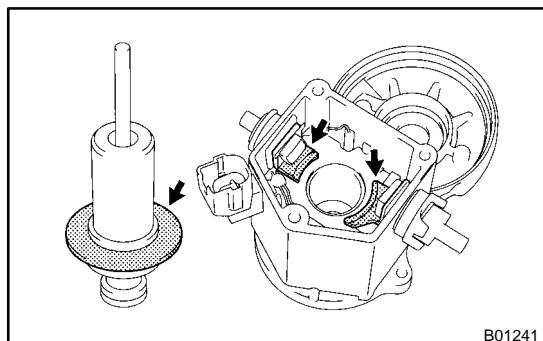
(2) Using SST, tighten the nuts to the specified torque.

SST 09810-38140

Torque: 17 N·m (173 kgf·cm, 12 ft·lbf)

NOTICE:

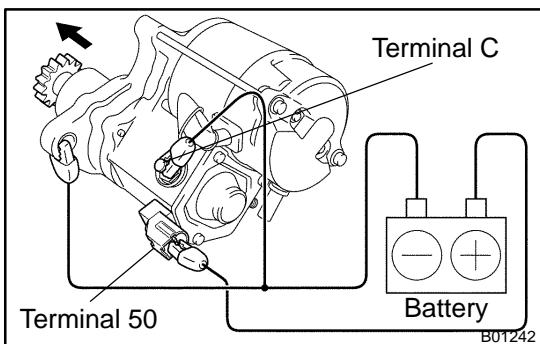
If the nut is over tightened, it may cause cracks on the inside of the insulator.



(g) Clean the contact surfaces of the remaining contact plate and plunger with a dry shop rag.

(h) Install the plunger, new gasket, end cover and 3 bolts.

Torque: 2.5 N·m (25 kgf·cm, 22 in.-lbf)



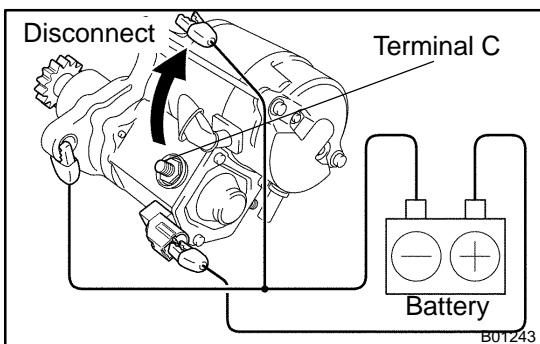
TEST

NOTICE:

These tests must be done within 3 to 5 seconds to avoid burning out the coil.

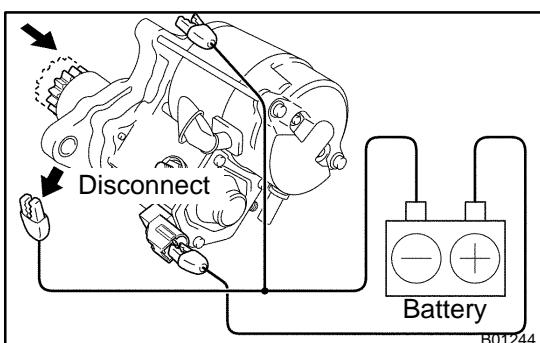
1. DO PULL-IN TEST

- (a) Disconnect the field coil lead wire from terminal C.
- (b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.



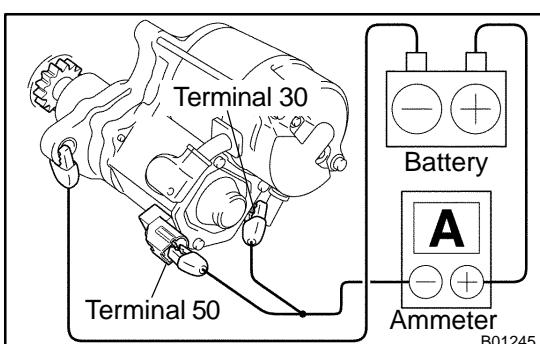
2. DO HOLD-IN TEST

With battery connected as above with the clutch pinion gear out, disconnect the negative (-) lead from terminal C. Check that the pinion gear remains out.



3. INSPECT CLUTCH PINION GEAR RETURN

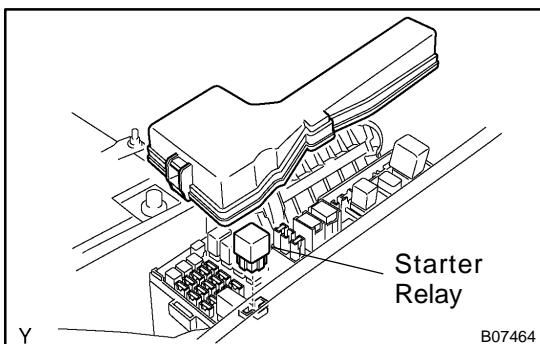
- (a) Disconnect the negative (-) lead from the switch body.
- (b) Check that the clutch pinion gear returns inward.



4. DO NO-LOAD PERFORMANCE TEST

- (a) Connect the battery and ammeter to the starter as shown.
- (b) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter shows the specified current.

Specified current: 90 A or less at 11.5 V

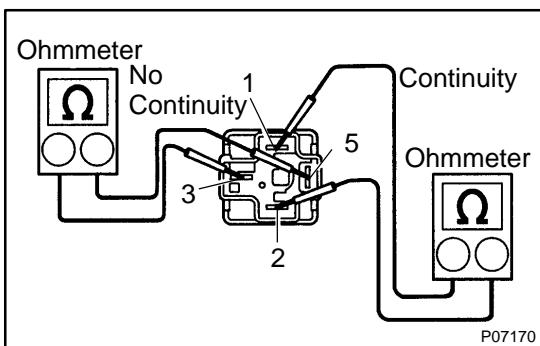


STARTER RELAY

INSPECTION

ST04V-02

1. REMOVE RELAY BOX COVER
2. REMOVE STARTER RELAY (Marking: ST)



3. INSPECT STARTER RELAY

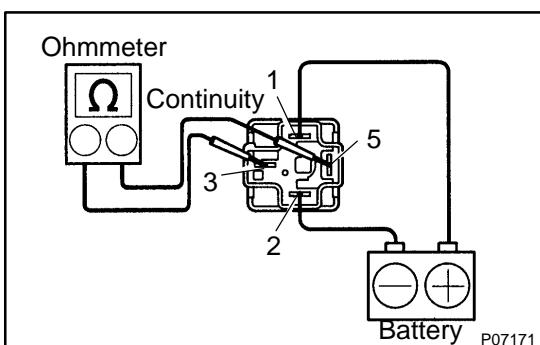
- (a) Inspect the relay continuity.

- (1) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

- (2) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.



- (b) Inspect the relay operation.

- (1) Apply battery positive voltage across terminals 1 and 2.

- (2) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If there is no continuity, replace the relay.

4. REINSTALL STARTER RELAY

5. REINSTALL RELAY BOX COVER

STARTING SYSTEM

ON-VEHICLE INSPECTION

ST04M-01

NOTICE:

Before changing the starter, check the following items again:

- Connector connection
- Accessory installation, e.g.: theft deterrent system